Spray Drift From Aerial Applications

Spray Drift Task Force

- Consortium of pesticide registrants
- Formed in response to EPA data requirements
- Supports registration of more than 2,000 products

Purpose of the SDTF Studies

- Quantify drift from ground, aerial, airblast and chemigation
- Use for risk assessments

Spray Drift is not Active Ingredient Specific

- Formulation/tank mix have small effect - but not the active ingredient itself
- Droplet size spectrum and height are the major variables
- Wind speed next, then less impact of relative humidity, application speed and non-volatile fraction

Spray Drift vs. Vapor Drift

- SDTF measure primary spray drift
- SDTF = movement of droplets and is generic
- Vapor drift = movement of gas and is product-specific

EPA Scientific Review

The information being presented is not an in-depth presentation of all data generated by the SDTF.

Use of pesticide products is strictly governed by label instructions.

Always read and follow the label directions.

What do the SDTF findings tell us?

- Confirm and quantify the factors affecting drift
- Droplet size is the most important factor
- Drift only occurs downwind
- Cannot totally eliminate drift with current technology
- There are many ways to minimize drift
- Most of the spray stays on target

Objectives

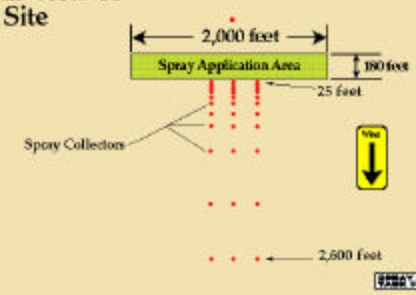
- Develop a generic database for evaluating a wide range of:
  - -Equipment combinations
  - -Atmospheric conditions
  - -Spray mixes
- Validate aerial spray drift model

Factors Affecting Drift from Aerial Application

- -Droplet size
- -Aircraft position (swath adjustment)
- -Nozzle height
- -Boom length
- -Wind speed and direction
- -Physical properties of the spray mix

Test Locations

Aerial View of Test Site



Droplet size is the most important factor influencing drift.

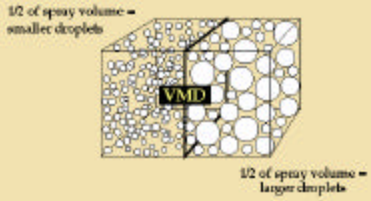
Droplet Size Studies

- Atomization studies in wind tunnels

Droplet Size Studies

- Atomization studies in wind tunnels
- VMD values from 106 to > 811 microns
- Percent Volume < 141 microns from 0.2% to 70%

VMD
Volume Median Diameter*



*In general, the bigger the VMD, the bigger the droplets.

Droplet Size Studies

- Atomization studies in wind tunnels
- VMD values from 106 to > 811 microns
- Percent Volume < 141 microns from 0.2% to 70%

Variables Affecting Droplet Size

- Nozzle type
- Nozzle orifice size
- Nozzle angle
- Aircraft speed

Nozzle angles

Test Application Variables

Nozzles and Angles

	Spray Volume (gal/acre)			
	≤ 0.5	> 0.5 - 2.0	> 2.0 - 5.0	> 5.0 - 25
Helicopter (60 mph)	-	8003 - 45°	D4-46 - 45°	D8 - 0°
Piston (110 mph)	8002 - 90°	D4-45 - 45°	D6-46 - 45°	D8-46 - 0°
" " "	8003 - 30°	-	-	D8 - 0°
Turbine (150 mph)	-	D4-45 - 45°	D6-46 - 45°	D8 - 0°

Percent Volume Less Than 141 Microns

	Spray Volume (gal/acre)			
	≤ 0.5	> 0.5 - 2.0	> 2.0 - 5.0	> 5.0 - 25
Helicopter (60 mph)	-	6%	6%	0.2%
Piston (110 mph)	45%	31%	15%	4%
" " "	40%	-	-	2%
Turbine (150 mph)	-	70%	39%	6%

Test Application Variables

Nozzle height: 6 feet - 31 feet
Boom length: 69% & 84% of wingspan
Carrier: oil or water

Physical properties of spray mix

Atmospheric Conditions

Temperature: 32°F - 95°F
Relative humidity: 7% - 94%
Wind speeds: 2 mph - 17 mph

Testing Challenge

Changes in atmospheric conditions between treatments

Solution

Apply a control treatment successively with each experimental treatment:

- Special aircraft equipped with dual application system
- Experimental treatment
- Control treatment
  - D6-46 nozzle
  - 45° orientation
  - 110 mph
  - 8 ft release height

Application Procedure

Successive Applications

- Experimental Treatment (6 swaths)
- Control Treatment (6 swaths)

Test Assumptions

- Differences between control treatments are due only to atmospheric conditions
- Differences between experimental treatments are due to atmospheric conditions and application procedures
- Differences between experimental and control treatments are due only to application procedures

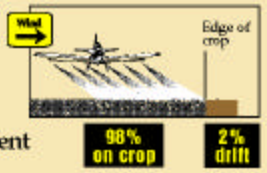
180 Total Applications

- 45 experimental treatments x 2 replications = 90
- 45 control treatments x 2 replications = 90

Findings

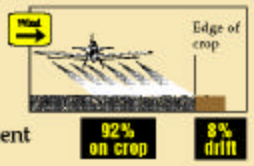
Typical Aerial Application

Air Tractor 401®
1200 ft wide field
Medium spray
10 mph crosswind
60 ft swath adjustment
8 ft nozzle height

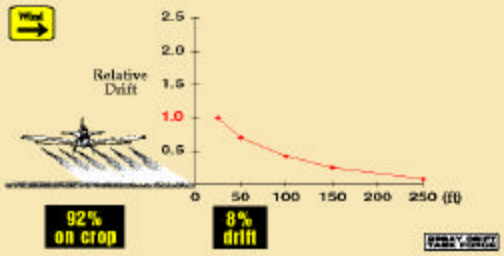


Average SDTF Control Application
(90 replicates)

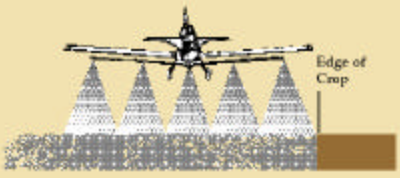
Cessna Ag Husky®
180 ft wide field
Medium spray
10 mph crosswind
50 ft swath adjustment
8 ft nozzle height



Drift from the SDTF Control Application
1.0 = 1.2 oz per acre

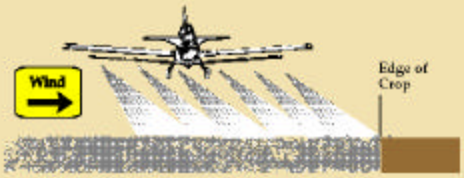


Application Without Crosswind



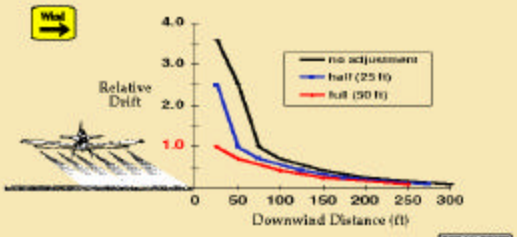
Application with Crosswind

Swath Adjustment for Crosswind

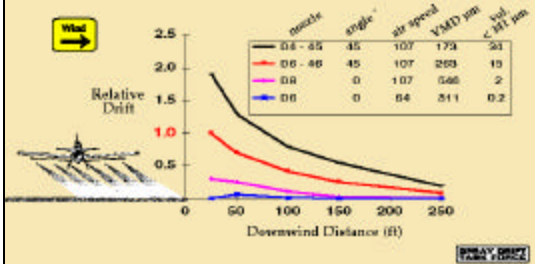


SDTF Applications
(No Swath Adjustment)

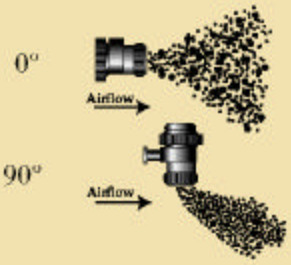
How swath adjustment affects drift
Control Application

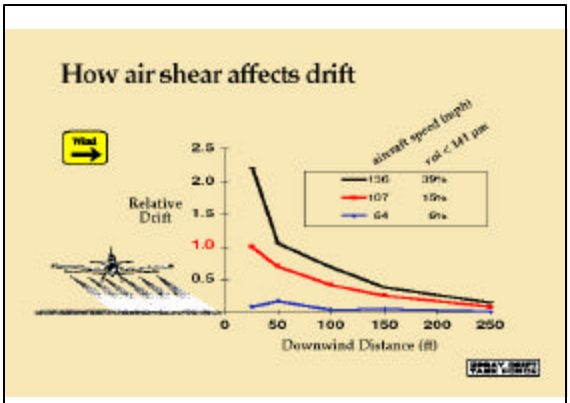


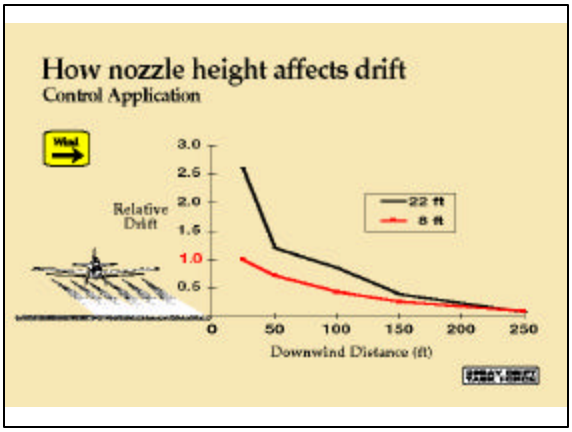
How nozzle and droplet size affect drift



How air shear affects droplet size

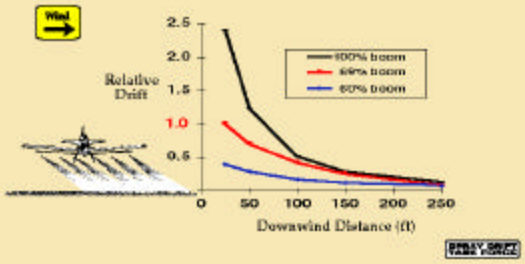



How air shear affects drift
Wind
Relative Drift
2.5
2.0
1.5
1.0
0.5
0
50
100
150
200
250
Downwind Distance (ft)


How nozzle height affects drift
Control Application
Wind
Relative Drift
3.0
2.5
2.0
1.5
1.0
0.5
22 ft
8 ft
0
50
100
150
200
250
Downwind Distance (ft)

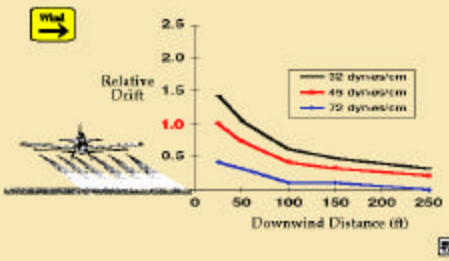
How boom length affects drift

Model-generated data for Control Application



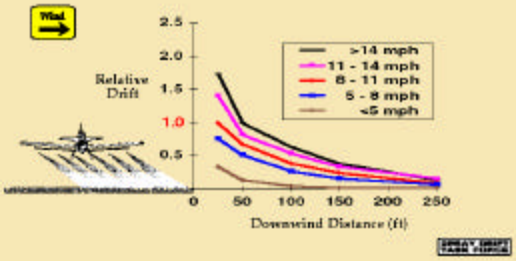
How dynamic surface tension affects drift

Model-generated data



How wind speed affects drift

Control Application



Factors Affecting Drift from Aerial Application

- -Droplet size
- -Aircraft position (swath adjustment)
- -Nozzle height
- -Boom length
- -Wind speed and direction
- -Physical properties of the spray mix

SDTF Data Will Be Used For Environmental Risk Assessments

- Active ingredients have very little affect on drift
- Active ingredients differ in potential for environmental effects
- Buffer zones can protect sensitive areas
- Buffer zones are upwind and adjacent to sensitive areas